

Client's ref.: TSMC2001-1472
Our ref.: 0503-8768-USf/Yianhou/Kevin/Nelson

DISPATCH METHOD AND SYSTEM

BACKGROUND

The present invention relates to manufacturing management, and particularly to a dispatch method and system for 5 Long-duration Processing Batch Equipment (LPBE) that reserves lots at preceding steps in the manufacturing process.

In semiconductor manufacturing, LPBE, such as furnace equipment utilizes long process time and batch process. As it requires several hours to rework defective lots, processing 10 quality and manufacture scheduling are important.

The manufacturing department controls process quality by defining processing time constraints for each lot passing through LPBE. The time between tracking out from the preceding step's equipment and tracking in to the subsequent step's 15 equipment for each lot should conform to the processing time constraint. Before entering LPBE, lots must enter the preceding step's equipment for removal of residual particles in advance.

In practice, each preceding step's equipment provides lots for different LPBE. Since there is no mechanism between the

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preceding step's equipment and LPBE to manage lot dispatch and stream, the quantity of dispatched lots for each LPBE may differ.

Therefore, the utilization rate of LPBE having fewer lots may be decreased, and those having more lots may be delayed,
5 undermining the processing time constraint, such that the lots needs to be reworked, thereby wasting processing resources.

SUMMARY

The present invention is proposed to address and solve the aforementioned issues. It is noted that the present invention
10 is applicable to any factory, service supplier, equipment and product.

Accordingly, it is an object of the present invention to provide a dispatch method and system for LPBE that reserves lots at preceding steps in the manufacturing process.

15 To achieve the above object, the present invention provides a dispatch method and system. The dispatch system includes LPBE, a plurality of equipment tools preceding the LPBE, and a dispatch unit. First, the LPBE retrieves equipment candidates having capabilities compatible with those of the LPBE among the

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preceding step's equipment in the dispatch unit, and selects at least one. Then, lots corresponding to the selected candidate are retrieved, grouped and sorted to obtain a plurality of batches, with at least one designated as a reserve batch.

5 Thereafter, the selected candidate performs processes corresponding to the compatible capability on the reserve batch, and forwards the processed batch to the LPBE.

The lots are first grouped according to the capabilities of the LPBE, such that a plurality of lot groups is obtained.

10 Then, the lots of each lot group and the lot groups are sorted according to a priority rule, such that the batches are generated. Additionally, each lot group is further split if the number of lots in the lot group exceeds the maximum loading that can be handled by the LPBE.

15 The priority rule is used to determine whether designated hot lots exist in any of the lot groups, and determine stage target, priority, and queue time for the lots in each lot group, and the quantity of wafers in each lot group.

The above-mentioned method may take the form of program code embodied in tangible media. When the program code is loaded

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into and executed by a machine, the machine becomes an apparatus
for practicing the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned objects, features and advantages of
5 this invention will become apparent by referring to the
following detailed description of the preferred embodiment with
reference to the accompanying drawings, wherein:

Fig. 1 is a schematic diagram illustrating the architecture
of the dispatch system according to the present invention;
10 Fig. 2 is a flowchart showing the process of the dispatch
method according to the present invention; and

Fig. 3 is a flowchart showing a process of grouping and
sorting according to the present invention.

DESCRIPTION

15 Fig. 1 illustrates the architecture of the dispatch system
according to the present invention.

In semiconductor manufacturing, lots must enter equipment
preceding the LPBE for removal of residual particles before
entering the LPBE. In the embodiment, the LPBE is furnace

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equipment, and the preceding step's equipment is cleaning equipment, but the invention is not limited thereto.

The dispatch system includes furnace equipment 110 (LPBE), a plurality of cleaning equipment tools 100, 101 and 102 (preceding step's equipment) preceding the furnace equipment 110, and a dispatch unit 120. After cleaning, tools 100, 101 and 102 forwards lots to the furnace equipment 110 for further processing. The furnace equipment 110 utilizes long process time and batch process, in which several lots are processed simultaneously.

The dispatch unit 120 controls the process flow of each lot, and provides information regarding thereto. The dispatch unit 120 includes a dispatch engine executing dispatch logic and generating a list of dispatched lots for each equipment tool.

15 The dispatch unit 120 provides reservation capability whereby the lots may be reserved for processing by designated equipment.

In advanced processing, equipment may have several capabilities to execute particular processes. To improve the utilization rate of the equipment, the capacity (CapaCapacity)

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of each capability and the required capacity (*reqCapaCapacity*)

of the capability are defined as follows.

CapaCapacity =

$$\frac{\sum (\text{eqp.capapeakThroughput} \times \text{eqp.capaplanAvailable})}{\text{eqp.capaavailable}}, \text{ and}$$

6 × 24

reqCapaCapacity =

$$\sum_{\text{lotrecp.capability=capabilityId}}^1 + \sum_{\text{lotnextRecp.capability=capabilityId}}^1$$

5 where *CapaCapacity* represents the total capacity corresponding to a specific capability of all equipment, the unit of the capacity being batch (one batch has 6 lots, and each lot has 24 wafers), *eqp.capapeakThroughput* represents the maximum capacity of the equipment in one hour,

10 *eqp.capaplanAvailable* represents a time ratio of the equipment performing process of the capability, and *reqCapaCapacity* represents the quantity of lots subject to process the capability in both current and preceding steps (equipment).

Consequently, if the *CapaCapacity* × 6 exceeds the
15 *reqCapaCapacity*, it means capacity exceeds requirement

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(demand). Otherwise, requirement exceeds capacity. To achieve capacity/demand balance and best utilization rate of equipment, the CapaCapacity × 6 and the reqCapaCapacity should be maintained equally, using the grouping, sorting, and 5 reservation mechanisms of the invention.

Fig. 2 shows the process of the dispatch method according to the present invention.

First, in step S201, furnace equipment 110 (LPBE) retrieves equipment candidates having capabilities compatible with those 10 of the furnace equipment 110 from among the cleaning equipment 100, 101 and 102 (preceding step's equipment) in the dispatch unit 120. It is noted that the capabilities of the cleaning equipment 100, 101 and 102 and furnace equipment 110 can be stored in the dispatch unit 120 in advance, or the dispatch unit 15 120 can receive candidate listing from a Manufacturing Execution System (MES).

In step S202, at least one of the candidates is selected, and in step S203, lots corresponding to the selected candidate are retrieved from the dispatch unit 120. Then, in step S204, 20 the lots are grouped and sorted to obtain a plurality of batches.

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Fig. 3 shows a process of grouping and sorting according to the present invention.

First, in step S301, the lots are grouped according to the capabilities of the furnace equipment 110, such that a plurality 5 of lot groups is obtained. In step S302, the lots of each group are then sorted according to a priority rule. If the number of the lots in any lot group exceeds the maximum loading of the furnace equipment 110, in step S303, the lot group is split until the number of the lots in each lot group is smaller than the 10 maximum. Then, in step S304, the lot groups are further sorted according to the priority rule, such that batches are generated, and each batch has a priority.

The priority rule is used to determine whether designated super hot lots and hot lots exist in any of the lot groups, and 15 determines stage target, queue time and priority of the lots in each lot group, and the quantity of wafers in each lot group. The priority rule respectively defines a weight for each determination item, such that each lot group has a respective total weight for sorting.

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Referring to Fig. 2 again, in step S205, at least one of the batches is designated as a reserve batch according to corresponding capability and priority. Thereafter, in step S206, the selected candidate (cleaning equipment) executes a process, corresponding to the capability, on the reserve batch,
5 and then forwards the processed batch to the furnace equipment 110. It is noted that the dispatch unit 120 can provide information of dispatched lots to both the selected candidate and the furnace equipment 110. Then, in step S207, the furnace equipment 110 then performs furnace process on the batch forwarded from the selected candidate.
10

The present invention thus provides a dispatch method and system for Long-duration Processing Batch Equipment (LPBE) that reserves lots at preceding steps in manufacturing process,
15 thereby increasing utilization rate and ensuring the process quality of LPBE.

The method and system of the present invention, or certain aspects or portions thereof, may take the form of program code (i.e., executable instructions) embodied in tangible media,
20 such as floppy diskettes, CD-ROMS, hard drives, or any other

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machine-readable storage medium, wherein, when the program code is loaded into and executed by a machine, such as a computer, the machine becomes an apparatus for practicing the invention.

The method and systems of the present invention may also be

5 embodied in the form of program code transmitted over some transmission medium, such as electrical wiring or cabling, through fiber optics, or via any other form of transmission, wherein, when the program code is received and loaded into and executed by a machine, such as a computer, the machine becomes

10 an apparatus for practicing the invention. When implemented on a general-purpose processor, the program code combines with the processor to provide a unique apparatus that operates analogously to application specific logic circuits.

Although the present invention has been described in its

15 preferred embodiments, it is not intended to limit the invention to the precise embodiments disclosed herein. Those skilled in this technology can still make various alterations and modifications without departing from the scope and spirit of this invention. Therefore, the scope of the present invention

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shall be defined and protected by the following claims and their
equivalents.